Electronic Supplementary Material (ESI) for Photochemical & Photobiological Sciences.

Supplementary Information

Title: Carotenoid biosynthesis of pak choi (*Brassica rapa* ssp. *chinensis*) sprouts grown under different light-emitting diodes during the diurnal course

Authors:

Katja **Frede**[ab], (frede@igzev.de); Monika **Schreiner**[a], (schreiner@igzev.de); Rita **Zrenner**[a], (zrenner@igzev.de); Jan **Graefe**[a], (graefe@igzev.de); Susanne **Baldermann**[ab], (baldermann@igzev.de)

Affiliations:

[a] Leibniz Institute of Vegetable and Ornamental Crops, Plant Quality and Food Security, Theodor-Echtermeyer-Weg 1, 14979 Großbeeren, Germany

[b] University of Potsdam, Institute of Nutritional Science, Department of Food Chemistry, Arthur-Scheunert-Allee 114-116, 14558 Nuthetal, Germany

Table S1. Primer pairs used for gene expression analysis by RT-qPCR

Protein (*gene name*)	Primer pairs (5' to 3')		E (%)
Carotenoid biosynthesis genes			
Phytoene synthase (*PSY*)	F: GATACCCTGTCGATATTCAGCCATTTAGAG	R: CCCATAACCGGAACGCTCATCA	87
Phytoene desaturase (*PDS*)	F: CCATGTCGTCAAAACTCCAAGGTC	R: GAGCAGAATTTGCCAGAGAGAACG	95
ε-Cyclase (*εLCY*)	F: CTACGGTGTTTGGGAAGATGAGTT	R: TGGAGCTAAGATACGAGACACCTGAC	97
β-Cyclase (*βLCY*)	F: CCCGTTTGATGTGGATAAGATGGTG	R: CCGGCCTAGCGACAAGAGACG	94
β-Carotene hydroxylase 1 (*β-OHASE1*)	F: TCTTGGCAAATGGAGGGAGGTG	R: CAAAGAGAAGCGTGCCAGAGAGC	93
Cytochrome P450 97C1 (*CYP97C1*)	F: GCGAAAGCACAAGAGGAAGTAGAC	R: CAAGACAGGAGGATGAGGGTAGAG	90
Cytochrome P450 97A3 (*CYP97A3*)	F: GAGCCTTCACTGTACGCAAATCCA	R: ATCTTCGTTAGCTCCGGTCCAATC	77
Zeaxanthin epoxidase (*ZEP*)	F: GGTGTTGGGCTTGGTCCTCTCTC	R: GGCGGTCATCAGCTTTGTCAGTG	90
Violaxanthin de-epoxidase (*VDE*)	F: GGTGTTGTAGCTTGCGCGTTTCTC	R: TTGGCTGCACAGGAAGGGTTG	95
Carotenoid degradation gene			
Carotenoid cleavage dioxygenase 4 (*CCD4*)	F: GCTTTCTTCTGTAACCGCCTCTTC	R: CTGTCATGCTCATCGCTAACTTCC	98
Transcription factors			
Elongated hypocotyl 5 (*HY5*)	F: AAGAGAGAGGAAGAAAGCTTACTTGGGTG	R: CCTCCTCTCTTGTTTCCTGTTGTGTTC	96
Circadian clock associated 1 (*CCA1*)	F: TCACGGGAACAGGGGAATAACAAG	R: GGACTGATGATGGCCTGAAACTGTG	100
Reference genes			
Actin 2 (*ACT2*)[a]	F: ACGTGGACATCAGGAAGGAC	R: CTTGGTGCAAGTGCTGTGAT	94
Ubiquitin-conjugating enzyme E2 30 (*UBC30*)	F: CACTGGCAAGCAACTATTATGGGTCC	R: CATTGCTGTTGATGTTCGGGTGATA	99
Elongation factor 1-alpha (*EF1α*)	F: CCCAAGTTTTTGAAGAATGGTGA	R: ACGGTCTGCCTCATGTCCCT	89

E, Amplification efficiency; a, (Wiesner *et al.*, 2013)

Wiesner M, Zrenner R, Krumbein A, Glatt H, Schreiner M. 2013. Genotypic variation of the glucosinolate profile in pak choi (*Brassica rapa* ssp. *chinensis*). Journal of Agricultural and Food Chemistry **61**, 1943-1953.

Table S2. Accession numbers of the nucleotide sequences used for primer design

Gene name	BRAD gene ID	GenBank accession number
PSY	Bra023603	XM_009127923.2
	Bra006391	XM_009133335.2
	Bra008569	XM_009123157.2
PDS	Bra032770	XM_009141294.2
	Bra010751	XM_009111318.2
εLCY	Bra020718	XM_009131456.2
	Bra006838	XM_009133907.2
	Bra002769	XM_009121973.2
βLCY	Bra029825	XM_009148612.2
β-OHASE1	Bra013912	GQ178285.1
	Bra019145	NM_001301961.1
CYP97C1	-	CX193390.1
CYP97A3	Bra038437	XM_009109855.2
ZEP	Bra037130	XM_009114104.2
	Bra012127	XM_009105212.2
VDE	Bra018616	XM_009149862.2
CCD4	Bra013378	XM_009134330.2
	Bra020970	XM_009110169.2
HY5	Bra008976	XM_009123723.2
	Bra023317	XM_009127550.2
CCA1	Bra004503	XM_009144346.2
UBC30	Bra035605	XM_009128717.2
EF1α	Bra020251	XM_009128363.2
	Bra031605	XR_628112.1
	Bra018242	XM_009145956.2
	Bra030707	XM_009112667.2
	Bra018669	XM_009149797.2
	Bra006661	XM_009133668.2
	Bra020253	XM_009128361.2
	Bra002483	XM_009122323.1
	Bra031602	XM_009120161.2

BRAD, Brassica database (http://brassicadb.org/brad/)

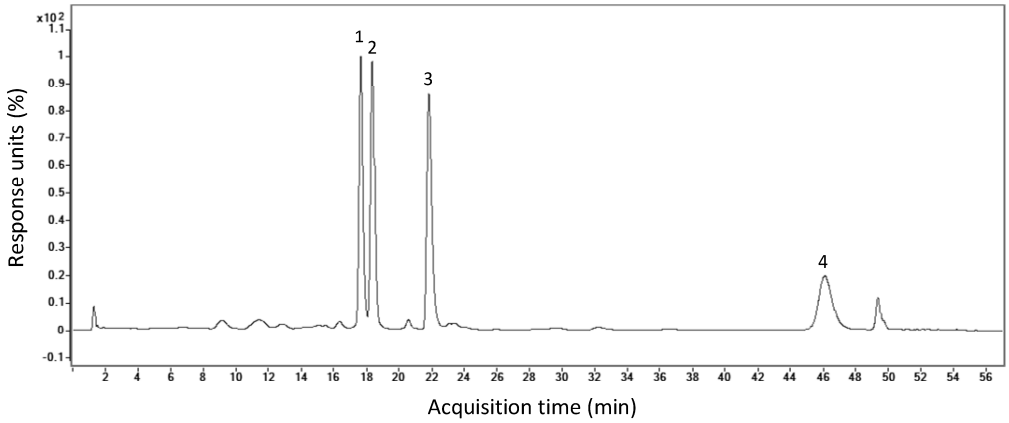

Fig. S1 Characteristic chromatogram (450 nm) of carotenoids and chlorophylls in pak choi grown under white LEDs: 1 chlorophyll a; 2 lutein; 3 chlorophyll b; 4 β-carotene

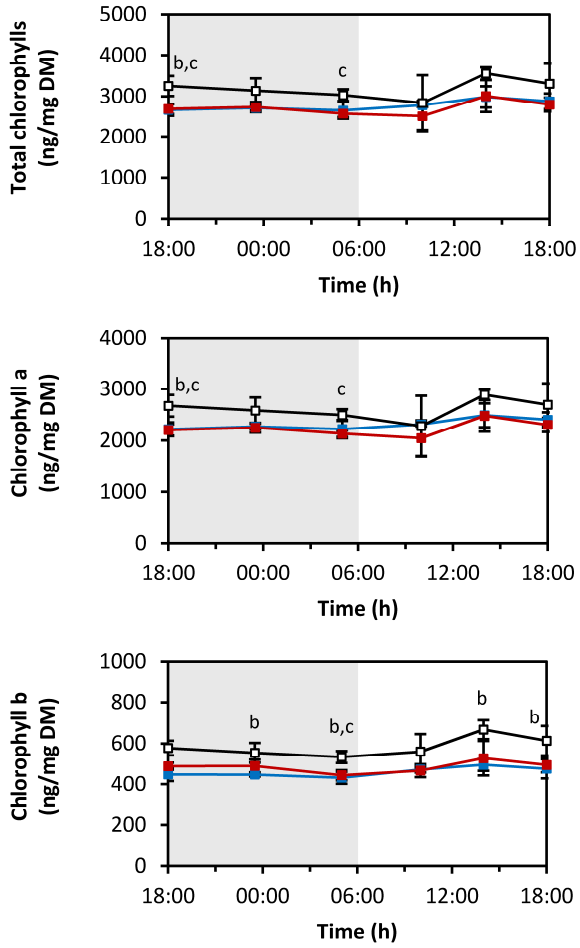

Fig. S2 Diurnal chlorophyll concentrations in pak choi sprouts grown under three different light qualities. Sprouts were germinated in complete darkness for five days. Subsequently, the sprouts were grown under blue, red or white LEDs for six days and were harvested throughout the final day. Chlorophylls were determined by LC-ToF-MS analysis. Values are presented as mean ± SD (n = 3). The marker fill colours of the data series match the LED colours. Significant differences ($p \leq 0.05$) are indicated by lower case letters (b – blue significantly different to white, c – red significantly different to white).